United Kingdom Overseas Territories Aviation Circular

OTAC	**77-2**	**139-24**
	91-10	**140-9**
	119-14	**145-14**
	121-15	**171-6**
	125-13	**172-9**
	135-15	**176-6**

Safety Assessments

(Aeronautical Studies, Safety Cases, Risk Assessments)

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GENERAL

Overseas Territories Aviation Circulars (OTACs) are issued to provide advice, guidance and information on standards, practices and procedures necessary to support Overseas Territory Aviation Requirements. They are not in themselves law but may amplify a provision of the Air Navigation (Overseas Territories) Order or provide practical guidance on meeting a requirement contained in the Overseas Territories Aviation Requirements.

PURPOSE

This Overseas Territories Aviation Circular provides guidance on the production of safety assessments to meet OTAR requirements and the need to identify alternative means to achieve an objective safely, without unacceptable risk. The principles contained in this OTAC may be applied in circumstances where requirements cannot be met and an alternative means of compliance is proposed.

The principles of this OTAC apply, equally, to the assessment of day-to-day issues that may be encountered within an operation. Within the framework of the safety management system organisations are required to assess issues/situations routinely. Whilst these situations may not warrant the formality of the assessment, the process is the same.

Equally, this process should also be applied and documented when an organisation considers known hazards within compliant situations but is seeking improvements to levels of safety.

RELATED REQUIREMENTS

This Circular relates to all OTAR Parts which require safety assessments.

CHANGE INFORMATION

This Circular replaces the previous OTAC on Aeronautical Studies.

ENQUIRIES

Enquiries regarding the content of this Circular should be addressed to Air Safety Support International at the address on the ASSI website www.airsafety.aero or to the appropriate Overseas Territory Aviation Authority.

TABLE OF CONTENTS

1 Introduction

1.1 There may be circumstances where there is a need to identify alternative means to achieve an acceptable level of safety or to manage risks as low as reasonably acceptable, especially where full compliance with a specific OTAR requirement cannot be achieved. This OTAC provides broad guidelines as to how this may be done.

1.2 There is a range of safety assessments within the aviation industry including risk assessments, safety assessments, aeronautical studies or safety cases. However, the same basic structure applies to each of them. In this document the term “safety assessment” is used to describe the processes listed above.

1.3 A safety assessment is an element of the risk management process of an SMS. It is used to assess safety concerns arising from, among other things:

- non-compliance with standards, applicable regulations or requirements (OTARs); or
- situations where compliance with a particular requirement cannot be (fully) met for physical, technical or reasonable cost benefit reasons; or
- when an activity; or task is required that is outside the scope of SARPs; or
- as part of a management of change process; or
- when any other safety concerns arise.

1.4 The objective of assessments is to determine an acceptable level of risk management.

1.5 If the organisation has any doubts regarding the need for a safety assessment, an early discussion with the regulator may determine the need for one, and clarify the key objective(s) or scope. This may save wasted effort later in the process.

1.6 It is important to note that the **objective must always be to seek compliance with the requirements**. In order to achieve an acceptable level of safety by other means, mitigating measures must be established to ensure a level of safety that is acceptable within the organisation’s Safety Management System.

1.7 The process of a safety assessment is set out in Figure 1 below.

2 How to use this OTAC

2.1 This OTAC provides basic guidance on how a safety assessment may be carried out.

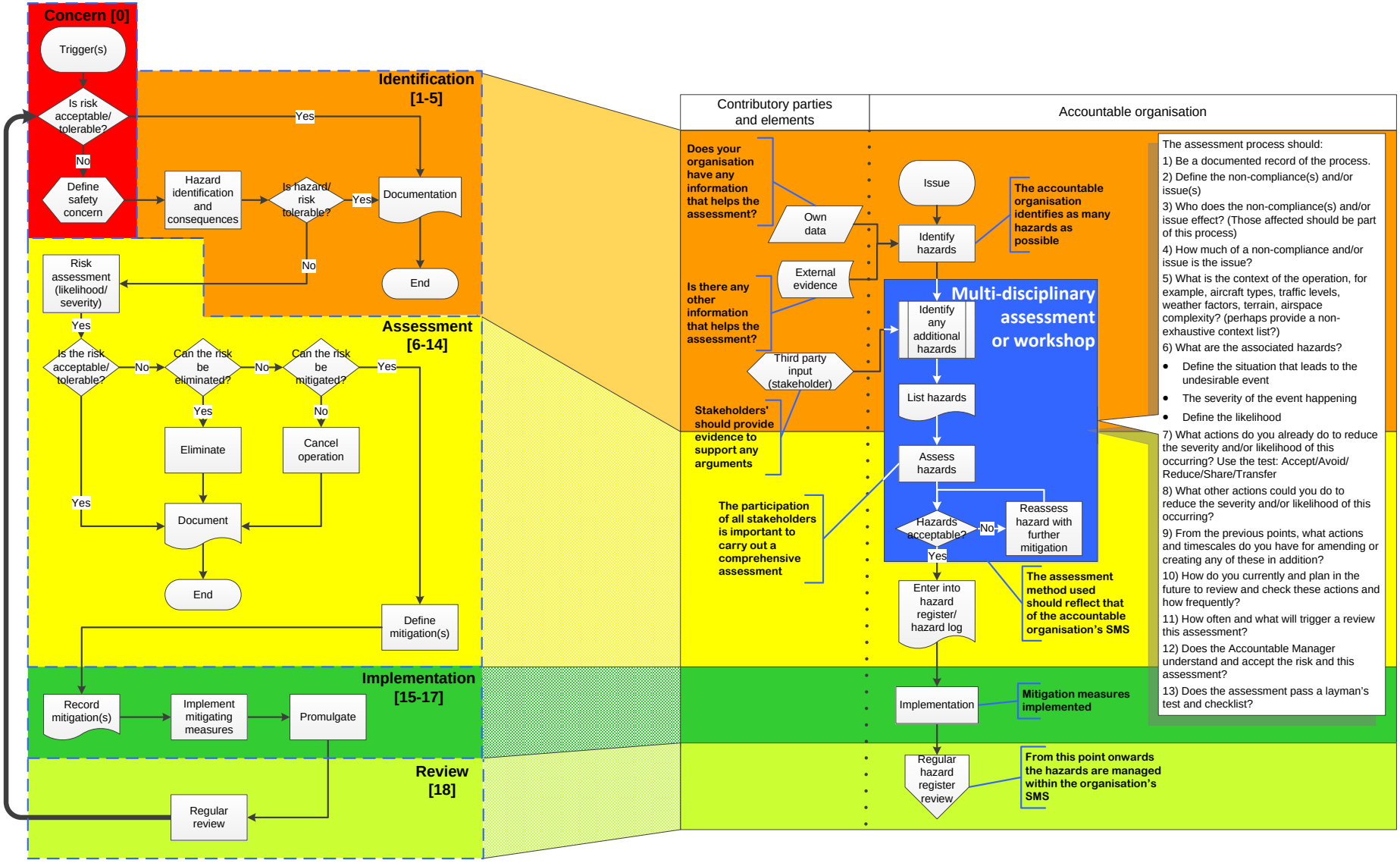
2.2 Figure 1 illustrates the overall basic process, with additional detail on the content of the assessment process.

2.3 Section 3 provides a checklist that may help provide guidance through an assessment.

2.4 Section 4 provides additional examples to help illustrate the type of content that fits into each stage of the process.

2.5 Colour coding is used to help identification and matching of the various steps of the assessment process outlined in this document.

Figure 1 – Safety assessment process



3 Safety Assessment Checklist

This section may be used as a template or checklist to aid the structure and production of a safety assessment. Additional guidance on how to interpret each section of the checklist is given in the explanatory notes (Section 4).

Ref.	Section	Example content	Assessment Reference
0	***Safety Concern or non-compliance***	Triggers may include: Accident/incident trends Non-compliance with regulation/standards Known long-standing non compliances (legacy situations) Aerial work New process or equipment Change of process or equipment Reporting scheme finding Incident report/investigation Feedback or issue raised by an operator/ user or other credible source	
1	***Introduction***	Brief description of the circumstances and issues to be assessed.	
2	***Objectives and scope***	Purpose of the document. Statement of the issues. Objective of the assessment. What is included in the assessment. What is excluded and by what justification. Who conducted the assessment and who contributed to it, including a list of participants in the study, their involvement and/or expertise.	
3	***Basic considerations***	This is the context of the assessment. Description of the issue. Are there any factors affecting compliance or the need for an alternative. For example, any special requirements imposed by the operating environment. Physical and/or topographical constraints. Engineering considerations.	
4	***Principle(s) of the original requirement(s)***	Brief explanation of the purpose of the Requirement(s). The risk assessment principles being applied.	
5	***Identification of hazards***	A list of all the hazards covered by the study, i.e. all unmitigated/mitigated hazards.	
6	***Assumption(s) (including justification)***	Any assumptions applied in the assessment/analysis.	
7	***Causal Factors***	Identification of causal factors. These are the undesirable events that contribute most to the risk, and other factors that influence those	

Ref.	Section	Example content	Assessment Reference
		undesirable events.	
8	***Risk***	Likelihood and severity assessment.	
9	***Analysis***	Analysis of assessment results. Description of acceptability/unacceptability of risk.	
10	***Mitigation***	Risk reduction/removal measures.	
11	***Discussion of individual elements***	If doing something different the reason for not being able to comply and the rationale for the alternative proposal. The risk assessment (likelihood, severity, and mitigation).	
12	***Estimate of effectiveness of mitigation(s)***	Analysis of mitigation effectiveness. Test the mitigation using the assessment process steps 8-11. If the results are within the organisation's range of acceptability proceed to 13.	
13	***Results***	Result of assessment. The conclusions reached from the assessment. Reasoning supporting conclusions.	
14	***Recommendation(s)***	Recommended solution or course of action.	
15	***Action Plan***	Action or implementation plan with timescales.	
16	***Appendices***	Any supporting information, data, drawings to aid clarity or support the assessment.	
17	***Document check***	Does the document make sense? Is it complete? Does the organisation (the accountable manager or the Board) accept and understand the document? Does the Accountable Manager understand, agree and accept the conclusion? If there are any doubts, discuss the document with the Regulator?	
18	***Review Cycle***	Include the frequency at which the assessment will be reviewed to ensure any intervening changes have not been overlooked. To test on-going applicability and appropriateness.	

Post-assessment process

Ref.	*Task*	Rationale	
19	***Submission to the Regulator***	The organisation should check and finalise the report for logic, balance and completeness. Internal peer review may be a useful tool to confirm readiness of the study prior to submission.	

20	***Regulator review***	The regulator checks the study for logic, balance and reasonableness. Regulator feedback may require elements of the assessment to be revisited. *Note: If a range of aviation disciplines have been involved in creating the document, the regulator will carry out the review using a range of staff from different disciplines.* *The regulator accepts the study and **not** the non-compliance.*	

Ref.	***Task***	**Rationale**	
21	***Post-assessment***	The hazards identified in the assessment should be incorporated into the organisation's hazard register/log and be subject of regular review within the SMS.	

4 Explanatory notes

This section provides some supporting notes and examples that may help authors of safety assessments.

Before you start:

1. It may be beneficial to have a discussion regarding the issues at an early stage with the regulator to ensure that:

    a. it is appropriate to carry out an assessment;

    b. the most appropriate type of assessment is chosen;

    c. the scope of the proposed assessment is sufficient; and

    d. guidance is sought from the regulator.

    If there are any doubts, concerns or clarification is needed at any stage of the process, discussion with the regulator may be helpful.

2. Define the operation, facility or activity (and any future plans if possible) to help set the context of the assessment. For example, is it to meet future growth; or to introduce new technology or a new system; or is it a modification?

3. It is recommended that the study is incorporated into the organisation's Quality Management System.

Consider why the assessment is needed.

Ref.	Note	Notes or Examples
0	Triggers may include: Accident/incident trends, investigation outcomes Non-compliance with regulation/standards Aerial work Feedback/issue raised by user/operator or other credible source Feedback or issue raised by an operator/ user or other credible source. Is the assessment required?	If there are doubts about whether an assessment is appropriate, contact the regulator for advice.
1	**Introduction** Concise, brief summary of the circumstances and issue(s) addressed by the document. Define the non-compliance(s), problem(s) and/or issue(s).	Your corporate house-style may require the inclusion of an executive summary. Regulation AAA requires that the BBB is CCC. The BBB is XXX and therefore non-compliant with the regulation. The BBB when RRR occurs can present a hazard to the operation of aircraft. This document aims to explore and assess this hazard within the context of our current and planned future operations.
2	**Who should perform the study?** The organisation responsible for managing the particular issue requiring assessment should lead the study.	Depending on the technicality or complexity of the issue, the organisation may retain a third party to conduct the study. However, the report/output must be owned and submitted by the organisation holding the approval. The regulator should have limited communication with consultant except, for example, to explain regulations.
3	Depending on the issue, those who should be involved may include ATC, RFFS, Security, aircrew, maintenance engineers. Bear in mind the regulator may use a multi-discipline team for their review. Potential participants may include: Air Traffic Control staff; Air Traffic Control Engineers; Airport	Operations; Airport Engineers; Airports planners; Airport safeguarders; Airport Police; Airport Customs; Airport Immigration; Environmental staff; Aeronautical ground lighting Engineers; Rescue and Fire Fighting; Handling agents; Fuellers; Wildlife hazard staff; Security; Airside drivers; Passenger service agents; Aircraft loaders; Commercial pilots; General aviation pilots; Helicopter pilots; Cabin crew; Aircraft engineers; Airline operations staff; Airline dispatch staff; Check in staff; Aircraft cleaners; Airline caterers; Third party contractors; Regulators

Ref.	Note	Notes or Examples
4	**A description of issue(s) and objective(s)** The first step of any risk analysis is to define the issue and the objective(s) of the exercise. Identify applicable regulatory requirements and understand the objective of those requirements. Identify what prevents compliance with the requirements. Ask, "what is the context of the operation?" For example this may include, aircraft types, traffic levels, weather factors, terrain, airspace complexity? The challenge is to identify the safety implications of the issue by: a) not complying (in full) with a certain requirement or requirements; or b) employing an alternative means to achieve an equivalent level of safety. The objective, based on an understanding of the requirement, is to identify and justify suitable mitigating measures, which do not degrade safety unacceptably.	ICAO Docs/Annexes, OTARs Clearly Identify what cannot be met, and why, hence establishing what purpose is not being met. Increasing movement numbers may increase a risk More 'modern' aircraft may reduce a risk. Obstacle penetrations (where, by how much, etc.). Context list may include: Current special pilot qualifications/restrictions, special aerodrome requirements/restrictions/special pilot briefs. Weather, temperature, visibility, wind speed/direction, turbulence. Geographical, altitude, light conditions, ground condition, water depth, water conditions, minimum sector altitudes, go around complexity. Flight types, scheduled, chartered, training, pleasure, helicopter, single/multi-piston, turbo-prop, jet, aircraft size, frequency, passenger/cargo loads full/restricted, aerial works, dangerous goods, night/day, movement flow flat/peaks, proportion of based vs. visiting pilots. ATC control type, services available, neighbouring ATC control type/ relationship. Future plans, changes, lessons learnt, incident investigation outcomes. Aerodrome design aircraft, airport coding, layout simple/complex, sightlines, parking design/guidance, obstacle environment, aerodrome lighting scale/backup systems, RFFS category, RFFS access routes/extra staff/equipment, approach aids, minima, power back up systems, weather monitoring/reporting, neighbouring aerodromes interactions, aircraft fuel engineering availability, fuel farm layout, fuel distribution system.

Ref.	Note	Notes or Examples
5	**Identification of the undesired events (hazards)** The next step is to carry out an exhaustive study to establish significant triggers that can lead to the catastrophic events (potentially this may reveal new catastrophic events). Try and rank how much of a non-compliance and/or issue is the issue? This will help prioritise the action plan. Hazards are any situation or condition that has the potential to cause damage or injury. The basic question one must ask is: 'what can go wrong and where'? The key is to identify hazards against which the requirement in question is designed to protect. Keep the descriptions suitable and appropriate for the assessment being carried out.	Review of issues identified in 3 above. Examples of 'what' include, but not limited to: - Aircraft colliding with terrain, aircraft, vehicles, people or objects. - Aircraft landing before the threshold; running off the far end of the runway or veering off the side of the runway. - Aircraft colliding with, or ingesting wildlife or foreign objects. - Effects of adverse weather. Examples of 'where' include, but are not limited to: - During flight (approach, landing, baulked landing, taxiing (including parking, take-off, climb-out) - On the ground (Runway, taxiway, apron, strips, RESAs, or outside these areas) (E.g. air/ground, systems/human). Can be higher level cause-consequences (i.e. overshoot then collision with ground). Collision with ground. No guidance in IMC. Over/Undershoot. Loss of separation. Midair collision.
6	**Assumptions** If any assumptions are used they should be stated. Assumptions are elements that may be excluded in the study; or they may be elements based on future planning, such as a larger aircraft type. Assumptions, particularly exclusions, must be logical and supportable. Exclusions, just because they do not suit the argument are not acceptable. For example, the study may be limited to a particular aircraft type, which means that should a different type becomes applicable, this study will not be valid and it should be reviewed and revised.	Assumptions may include issues such as: The current traffic mix and/or schedules. Current operating hours. Weather patterns are going to change or remain the same. Transfer of existing technology, or the introduction of new technology. Reference to other, similar, authoritative assessments or papers may provide useful evidence to support an argument.

Ref.	Note	Notes or Examples
7	**Analysis of causal factors, severity and likelihood (risk assessment)** **Causal factors** The basic questions are: a) why can it go wrong and; b) if it does goes wrong what are the consequences; and c) how likely is it that it will go wrong? Are there any actions you do already do to reduce the likelihood (probability) and/or severity (effect/impact) of this occurring? Use the test: Accept/Avoid/Reduce/Share/Transfer **Description of risk** The Risks are the potential adverse consequences of a issue or hazard, and are the result of the severity and likelihood assessment. Each risk can be described using an appropriate severity/likelihood risk assessment matrix, which should be part of the responsible organisation's SMS. At this point you may have to repeat the process if you have identified any additional associated hazards. • What are the associated hazards? • Define the situation that leads to the undesirable event. • Define the event (likelihood). The effect (severity) of the event happening.	The investigation should identify the factor or factors that could lead to the undesirable outcome. Removal or mitigation of these causal factors should reduce the likelihood of occurrence, but a possibility of occurrence will nevertheless remain. Ideally, the potential root cause should be identified and measures taken to remove, or at least, mitigate it to an acceptable level. A useful and recognised evaluation technique is to ask the '5 whys'[1]. This facilitates drilling down into an issue and, generally, should identify the potential root cause which can then be addressed. Removing a root cause will generally also remove the associated causal factors.

[1] **The '5 whys'** – By asking the question "Why" it is possible to separate the symptoms from the causes of an issue. This is critical as symptoms often mask the causes of issues. As with effective incident classification, basing actions on symptoms is unlikely to identify the root cause of the issue. Using the technique effectively will define the root cause of any non-conformances and subsequently lead you to defining effective long term corrective actions. A simple example is:

- The vehicle will not start. (the issue)
1. ***Why?*** - The battery is dead. (first why)
2. ***Why?*** - The alternator is not functioning. (second why)
3. ***Why?*** - The alternator belt has broken. (third why)
4. ***Why?*** - The alternator belt was well beyond its useful service life and not replaced. (fourth why)
5. ***Why?*** - The vehicle was not maintained according to the recommended service schedule. (fifth why, a root cause)

Information is readily available on the internet and on at https://en.wikipedia.org/wiki/5_Whys

Ref.	Note	Notes or Examples
8	**Severity** The next question is, what are the (potential) consequences if it goes wrong? For this element, it is important to determine descriptions for each level of severity. The descriptions should be as comprehensive as possible and not limited to any one point of view or discipline. The complexity of the severity descriptions will depend, to a large extent, on the complexity of the issue being assessed. In any case, the assessment process must be compatible with the organisation's SMS. **Likelihood** The next step is to assess, how likely is it that it goes wrong? This is a probability issue. How often is it likely to go wrong within a certain measure? The measure could be based on time, number of movements, frequency of activity or any other appropriate measure? If relevant and reliable data to make a quantitative assessment is available that is fine. If not, a qualitative assessment based on expert opinion or by a multi-disciplinary workshop can be used.	Use your standard risk assessment processes in this section.
9	**Analysis** Analysis of safety risks to establish some measure and ranking of the identified risks (e.g. severity, likelihood and proximity to risk). The analysis should be tested to determine that the results are realistic and credible. This is also an opportunity to check that the descriptions of risk acceptability/unacceptability fit within the organisation's system and is supported by the organisation.	Assuming, from the risk assessment process, the stakeholders agree that the issue is a significant concern and the risks are tolerable for the organisation and their operations, analysis is carried out. Analysis may be qualitative or quantitative: A qualitative approach based on common sense and qualified expert opinion will probably, in many cases, yield results that are far better than nothing, and better than a quantitative approach based on a limited set of unrepresentative or unreliable data. A quantitative analysis may be possible if reliable data exists to inform the analysis. If not, a qualitative assessment based on expert opinion can be used.

Ref.	Note	Notes or Examples
10	**Identification of possible mitigating measures** The results from the risk assessment matrix will provide guidance as to the acceptability or otherwise of the issue/hazard. Any element that is outside the tolerable range must be reviewed or addressed to remove or mitigate the hazard. Identification of mitigations (reducing risk) and design changes (removal of risk) to address identified risks.	The analysis should generate a set of mitigations to remove or reduce the risk(s). You need to decide whether the mitigations are realistic, practical and sustainable. If they are they may be adopted or implemented as part of the risk reduction exercise.
11	The organisation must therefore: a) take measures to reduce the organisation's exposure to the particular risk, i.e. reduce the likelihood component of the risk index; b) take measures to reduce the severity of consequences related to the hazard, i.e. reduce the severity component of the risk index; or c) cancel the operation if mitigation is not possible.	From these results risk reduction measures can identify and aim towards either reducing the likelihood of an occurrence, or reducing the severity of an occurrence. Some measures could do both. The first priority should always be to seek measures that will remove the likelihood of an occurrence (i.e. accident prevention). Second, look for measures to reduce the severity of consequences related to the hazard, i.e. reduce the severity component of the risk index. When contemplating mitigating measures, it is always necessary to look to the intent of the OTAR requirement that is not (fully) complied with. It should be anticipated that mitigating measures may apply controls and constraints on an activity or operation. Safety and usability is a balancing act! What other actions could you do to reduce the severity and/or likelihood of this occurring? Establish how effective the mitigations/changes are, commensurate with measure of risk of the non compliance established in step 5. What other actions could you do to reduce the chance of this occurring?

Ref.	Note	Notes or Examples
12	**Estimating the effect of mitigating measures** An exhaustive study ('sense check') of any risks introduced by mitigations/changes should be carried out and analysed again. This may require in further assessment The mitigating measures carrying risk elements should be fed back into the assessment process described above (steps 7-13) in order to check their relevance and effectiveness in reducing risk. Fully define the proposed mitigations/changes in relation detailed design.	Mitigations may introduce their own, hopefully lesser, risks in to the system. For example, a mitigation may be the wearing of breathing apparatus. Whilst this may address the primary issue (e.g. noxious gas), the management of breathing apparatus (e.g. duration of air supply, cleanliness of air supply, maintenance of valves and equipment, working with compressed gas) carries its own risks.
13	**Choice of mitigating measures to be used to remove/reduce the risk(s)** If one or more measures enable the risk to be sufficiently reduced, one can recommend a choice, bearing in mind that the preferred option should be accident prevention, and prepare the final report. Thus the final description should recommend mitigating actions and list the consequences and their likelihood when these are taken into account. **Presentation of results - Justification of tolerability of the assessment result(s)** The work shall be documented in such a way that it is possible to see what has been done. The steps referred to above should be identifiable.	Other key issues may include: - What essential assumptions, presuppositions and simplifications have been made? - Any uncertainty about the results due to the choice of and availability of methods, procedures and data sources should be discussed. The results of the study should clearly identify which undesirable events contribute most to the risk, and the factors that influence those undesirable events should also be examined. The risks and hazards that cannot be removed should be recorded in the organisation's risk register and regularly reviewed as part of its SMS review cycle. Have all the risks identified been addresses in some way? Check there are no significant identified risks left unaddressed in some form.
14	**Recommendations** Recommendations for measures to mitigate risk, their character and their estimated effect shall be stated.	Does the assessment pass a layman's test and checklist? Will everyone (staff, stakeholders, visitors) likely to be affected by the recommendations understand the measures to be taken?

Ref.	Note	Notes or Examples
15	**Action plan** Assuming rectification action is identified, the assessment/study should include an action plan, with timescales, to either achieve compliance or the recommended result. Also to preserve the ambition to seek compliance with original requirements allowing the withdrawal of the mitigations/changes. There is benefit if this can be part of the workshop, but it may not be possible to agree all actions at the meeting (e.g. for a high-cost recommendation, Board approval may be needed). However, every effort should be made to ensure that all actions within the delegation of the meeting should be agreed.	The action plan must be: **S** - specific, significant, stretching **M** - measurable, meaningful, motivational **A** - agreed upon, attainable, achievable, acceptable, action-oriented **R** - realistic, relevant, reasonable, rewarding, results-oriented **T** - time-based, time-bound, timely, tangible, trackable
16	**Appendices** Any useful supporting or informative information to help describe or support the study may be attached as appendices. The material may include drawings, calculations, images, other case studies or references.	-
17	Does the assessment pass a layman's test and checklist? Does the Accountable Manager understand and accept the risk and this assessment?	Is the assessment easy to understand? If you have a checklist, have all the items been addressed.
18	**Review Cycle** The SMS should include a cycle for review of risk assessments. Therefore, the study should be subject of review within the SMS. . How do you currently and plan in the future to review (check) these actions and how frequently? What are the justifications behind these? Establish a method by which the mitigations/changes are validated and subsequently monitored to conclusion. How often and what will trigger a review of this assessment?	Circumstances may change over time, alternative methods of mitigation may become available or compliance may become achievable, which may affect the deviation described and mitigated within the study.

Post-assessment process

Ref.	Note	Notes or Examples
19	**Submission to the regulator** The regulator will review the assessment or study independently to express an opinion regarding appropriateness, applicability and completeness. If the regulator considers the results and recommendations are reasonable, the organisation will integrate them into its SMS.	Where the regulator identifies an element or elements may be missing in the analysis; or it appears to be incomplete, the assessment/study may be rejected, and the organisation will have to address the issues identified. The regulator may challenge or question elements of the assessment on the basis of testing and validating the arguments used.
20	**Regulator review** The regulator examines the assessment for appropriateness; thoroughness; the balance of the arguments; logic and common sense. The regulator will comment on these elements and confirm that the organisation understands and is willing to carry any remaining risk (residual risk) within its safety management system. Depending on the subject matter, and where appropriate, the regulator will use a multi-discipline team of specialists to evaluate the assessment. The ownership of the assessment rests with the submitting organisation.	Example, where an aerodrome is assessing a steep approach PAPI installation, the regulator will get Flight Operations input to the assessment review.

Ref.	Note	Notes or Examples
21	**Post-assessment** Regularly review the assessment to test for validity, and review the assessment in the event of any change that affects its validity.	This is aimed at the organisation reviewing its own risks and hazards. However, it is likely that the regulator, as part of their audit process will revisit past assessments to at look relevance, progress of mitigations/action plans etc.

5 What happens to the assessment?

5.1 The safety assessment will be submitted to the regulator for evaluation. This is an independent review. The assessment will be checked against the regulations/requirements and the arguments used in the assessment considered for appropriateness, applicability and completeness. The regulator may question or challenge elements of the assessment where clarification is needed, or where the arguments are considered to be incomplete. This may require further work on the assessment.

5.2 The regulator will comment on these elements and confirm that the organisation understands and is willing to carry any remaining risk (residual risk) within its safety management system. The organisation will integrate them into its SMS. The ownership of the assessment rests with the submitting organisation.

5.3 A safety assessment, when accepted by the regulator, shall, if applicable, be noted and may be placed on file, as supporting documentation associated with related Approvals to signify the existence and conditions of non-compliance or difference.

5.4 The organisation should list all issues and non-compliances, that is issues and non-compliances controlled through mitigation(s) in the organisation's risk or hazard register and subject them to regular review to test for continued validity, and review the assessment in the event of any change that affects their validity.

5.5 It shall be the objective of an organisation to make every effort to remove the non-compliance, issue or difference. The safety assessment shall be integrated into the organisation's SMS so as to manage the legitimacy and review of the assessment.